

When, a few years ago, it became evident that the question of afforesting a portion of the British Isles had developed into a matter of considerable public importance, Edinburgh again led the way, and instituted a degree of B.Sc. in forestry and appointed lecturers to deliver the special courses which the forestry student is required to take, such as forest botany, forest chemistry, forest engineering, and forest entomology.

The University did not, however, rest content with this. The demands made upon the resources of the department led to the recognition of the fact that provision was required for three additional objects:—

(1) A forest garden, including an area for the experimental formation of woods.

(2) Extensions of the present museum and the provision of laboratories.

(3) Additional lecturers on the University forestry staff.

During the past year undivided attention has been devoted, in collaboration with the Edinburgh and East of Scotland Agricultural College, towards the attainment of these objects.

The Development Commissioners were approached by the University Court and the governors of the Agricultural College, and their applications were received with sympathetic consideration by the Commissioners, and have been accorded generous treatment.

A sum of money has been promised annually for a period of years for the rent and upkeep of a forest garden and area of experimental plantations. This sum has been promised conjointly to the University and College, and the authorities of these two institutions have appointed a joint committee to supervise the management of the area.

The Development Commissioners, recognising the urgent need of additional room for the extension of the forestry department within the University, its museums, and laboratories, have granted the University a sum of 4500*l.* towards the erection of a new forestry building, stipulating that the University should provide a similar sum. The University Court has undertaken to provide this amount, or a larger one should it be required. The Development Commissioners have also made a grant of 2000*l.* towards the equipment of the museums and laboratories, the money to be spent during the next five years. The Commissioners have promised to consider a further provision for this object should such be required at the end of this period. It is expected that the erection of the buildings will be commenced in the coming year.

The instruction in forestry proper for the degree will remain in the University, and with the object of supplementing the staff of the department the Development Commissioners have granted a sum of 2500*l.* (500*l.* a year for five years) as a provision for the salaries of an additional lecturer and for an assistant in the forestry department. One of these gentlemen has been already appointed, and the second will be shortly added to the staff.

The above detailed explanation of the present position of Edinburgh with regard to education in forestry will show that both the University and Agricultural College have gone thoroughly into the matter, and have determined that every effort shall be made to give the best forestry education possible alike to the student wishing to graduate in forestry and to the working forester and woodman who wishes to improve his education by following the simpler forestry courses delivered at the Agricultural College.

TESTS OF PROPELLERS FOR FLYING-MACHINES.

A SERIES of important and valuable experiments are being carried out at Chalais-Meudon by MM. Legrand and Gaudard with the object of testing propellers, while actually in use, on a flying machine, and of studying the action of the air on planes in flight. The machine used is a biplane specially built for the purpose at the laboratory; the propeller in front is run off a 60 horse-power Renault motor; the planes are staggered; and the total weight, including the pilot, is 780 kilograms.

In order to study the action of the air on the propeller and planes of a machine in horizontal flight, the following details must be known:—(1) the thrust of the propeller; (2) the speed of rotation of the propeller-blade or of the

motor; (3) the actual speed of the aeroplane as it would be in calm air; and (4) the angle of incidence of the machine. The way employed in these experiments is to take simultaneous and instantaneous readings of all these details by the aid of special apparatus connected electrically, so that the pilot can choose his own moment and take the readings by pressing a button. The method of obtaining the angle of incidence and the speed of the machine is particularly ingenious. It consists of photographing the angle indicator—a pendulum moving in oil—and the manometer recording the pressure of the air-flow. In this way observers are not required, and the factor of personal error is eliminated.

Experiments have already been made with two propellers, A and B, A having a diameter of 2.65 metres and a pitch of 2.10 metres, and B a diameter of 2.85 metres and a pitch of 1.70 metres. The motor gave out 62 horsepower at 1800 revolutions, which was its normal speed, but in the case of A the revolutions in flight went up to 1870, and in B to 1980. It was found that a considerable deformation of both propellers took place during flight by which the pitch was reduced equally on both blades of A by 350 mm., but unequally on B to the extent of 350 mm. on one and 270 mm. on the other, so that when B was used considerable vibrations were observed.

At a speed of 17 metres per second propeller A gave out 168 kilograms thrust when the angle of incidence was 9° 45', and at a speed of 16 metres, when the angle of incidence was 10° 15', the thrust was 160 kilograms. B, on the other hand, at a speed of 15 metres, when the angle was 11°, only gave a thrust of 153 kilograms.

In static tests, A gave 225 kilograms and B 245 kilograms. The experimenters, as an outcome of these preliminary tests, state that many of the modern propellers in use have too small a relation between their pitch and diameter to be really efficient.

Lieut. Saunier piloted the machine on its trials, making only short, straight flights when there was practically no wind.

NEW MICROSCOPIC OBJECTIVES AND ACCESSORIES.

WE have received from Messrs. Angus, agents for R. Winkel, of Göttingen, some of his later productions which include special features.

With regard to the objectives, they have been examined and reported on by Mr. E. M. Nelson,¹ whose authority on such matters is second to none, so we may content ourselves by referring to his statements relating to the special colour correction of the achromats which Winkel employs, especially as he introduces a history of the changes made in these corrections which is of great interest.

“Before the introduction of Jena glass, the outstanding secondary spectrum of the old English achromat consisted of claret, or port-red, and apple-green colours. This was always looked for by experts, and its presence was thought to denote perfect correction. About 1870 (or a year or so later) Tolles, in America, altered the correction, and produced some very fine object-glasses with a flaring bright red, or crimson, spectrum. I well remember seeing a *Podura* scale shown with one of these glasses, a very brilliant lens, and a strong diatom resolver; the exclamation marks shone out like rubies, whereas if they had been viewed through an English objective of that date (Lister formula) the exclamation marks would have been seen with a more purple tint, something like an amethyst.

“About 1886, when Jena glass was introduced, an entirely new set of phenomena appeared; pale glasses, and those which gave decidedly bluish tints—which any expert of those days would have unhesitatingly condemned—were found to be not only strong diatom resolvers, but also to give sharp and bright pictures. For a time, experts, until they had learnt the effect of the reduction of the secondary spectrum by these new corrections, were all at sea, and did not know where they were.

“To-day, there is in my cabinet one of these Jena glass semi-apochromats which has such a violent purple secondary spectrum that it can be seen even when a peacock-green glass is used, a more monochromatic fluid

¹ Journ. R. Micr. Soc., 1911, pp. 451-52.

screen being required to shut the blue part of the purple out! Yet this lens gives particularly sharp images, and is a very strong diatom resolver. Now, however, Herr Winkel has revived the American red corrections with Jena glasses. The result is excellent, for brighter, sharper, or, for their apertures, stronger resolving object-glasses will not be found. This red correction is peculiarly suitable, because a peacock-green glass screen turns red into black, and so makes a strongly contrasted image. When the *Podura* was first examined with the $1/7$ of 0.85 N.A., for the moment it was difficult to exclude the idea that one of the American red objectives was not on the nose-piece."

The outstanding colour in the fluorite objectives is of the same red tint. In these, of course, the outstanding colour is less, and their definition leaves nothing to be desired.

"Complanat" is a new word coined by Winkel for a new set of Huyghenian eye-pieces which are strictly achromatic and have a perfectly flat field.

Messrs. Angus have also sent us Winkel's new form of screw micrometer. This is based on a suggestion of Koch's. A combination of scale and screw replaces the combination of screw and thread, giving a ready means of obtaining the exact measurement of objects subtending a number of divisions of the scale, the fractional part only of an interval having to be determined by means of the screw. In the instrument real or lateral displacement is measured to $1/500$ mm., one turn of the screw travelling over two divisions of the scale, an arrangement which we think will be found inconvenient.

The microscope stand is a beautifully finished specimen of the Continental model; an extension of the horseshoe backwards would make it more stable. The graduation of the scales in the attachable mechanical stage, and its general finish, leave nothing to be desired; the old reputation of the firm for fine metalwork is still kept up.

We have also received from Messrs. Angus a microscope and objectives representing the latest productions of the eminent firm of Reichert, of Vienna, together with a catalogue. As was to be expected, both the optical and mechanical parts are of the highest excellence. In the catalogue the number of fluorite lenses employed in each apochromatic objective is stated. The apochromatic of N.A. 1.30 sent us is a magnificent lens with little trace of colour, and its definition does not break down under a power of 3000.

THE FLORA OF FORMOSA.

PREVIOUS to the acquisition of Formosa by Japan, in 1895, little was known of the vegetation of the mountains of the interior. Many European collectors had visited the island, but none had been able to penetrate the central range, on account of the hostility of the natives. The Japanese soon organised a Botanical Survey, and several botanists have been engaged in the investigation of the flora, the results of their labours having been published from time to time, mostly in English, with Latin descriptions of the novelties, and figures of some of the most remarkable plants. The forerunner was the "Enumeratio Plantarum Formosanarum," by J. Matsumura and B. Hayata, which appeared in 1906. This was followed in 1908 by Hayata's "Flora Montana Formosæ"; and the same author has now issued a bulky and important supplement.² As is stated on the title-page, Dr. Hayata worked out his collections at Kew, where he had the opportunity of studying numerous types of genera and species of Eastern plants first described by the Kew botanists.

This work and its predecessors are mainly statistical, descriptive, and pictorial, though publications on the economic botany of the island are not wanting. However, it is possible to extract much that is interesting in the composition of the flora. Taking Dr. Hayata's own

¹ A delicate test for colour is the raphæ of a Cherryfield Rhomboides, when mounted in balsam, quinine, or styrax.

² Materials for a Flora of Formosa. Supplementary Notes to the Enumeratio Plantarum Formosanarum and Flora Montana Formosæ, based on a Study of the Collections of the Botanical Surveys of the Government of Formosa, principally made at the Herbarium of the Royal Gardens, Kew. Journal of the College of Science, Imperial University of Tokyo, vol. xxx., 1911, pp. 471.

figures, the "Enumeratio" comprises 1999 species, belonging to 701 genera and 153 families; and the present supplement brings the numbers up to 2660, 836, and 156 respectively. It should be explained that these figures relate to the flowering plants and ferns and their allies only. In nearly all its features and generic elements the flora of Formosa is essentially Chinese, with a very large number of peculiar species. In all probability the number of species existing is far from exhausted; but the very small generic endemic element is not likely to be much increased by future explorations. Excluding ferns, Forbes and Hemsley's "Enumeration of Chinese Plants" includes representatives of 159 families, so that there are nearly as many in the smaller area as in the large. The same fact comes out in comparing a county flora with that of the whole of England, for example. Although the mountains rise to upwards of 13,000 feet, there is no real alpine flora in Formosa, though many genera are represented that are common to temperate and alpine zones.

Of the Cupuliferæ, the genera *Fagus*, *Alnus*, *Carpinus*, *Castanea*, *Castanopsis*, and *Quercus* are represented, the last-named by thirty-two species. *Salix* is represented by several species; *Populus* absent. About five and twenty Coniferæ are recorded, including *Chamaecyparis formosensis*, *Cunninghamia Konishii*, *Juniperus morrisonicola*, *J. formosana*, *Picea morrisonicola*, *Pinus formosana*, *P. taiwanensis*, *Tsuga formosana*, and *Taiwania cryptomerioides*, all of which are supposed to be peculiar to the island. The last is a monotypic genus endemic in Formosa. *Nepenthes* is not known to occur, nor *Pedicularis*, whereas in China there are about 150 species of the latter.

Vascular cryptogams are evidently strongly represented, as already there are on record upwards of 300 species of ferns, about twelve species each of Lycopodium and Selaginella, and two species of Equisetum. Orchids number about sixty species, mostly small-flowered and inconspicuous. The foregoing totals are partly compiled from Takiya Kawakami's "A List of Plants of Formosa," published in 1910.

W. BOTTING HEMSLEY.

THE INDIAN SALTPETRE INDUSTRY.¹

THE production of potassium nitrate in India is probably a very ancient industry, and at the present time, in spite of German competition, the export still amounts to about 20,000 tons per annum. As is well known, the potassium nitrate is extracted by natives from soil collected in the villages, where in all probability it has been formed by bacterial decomposition of the organic matter, with production first of ammonia and subsequently of nitrates. The chemical and bacteriological changes have not yet been studied, but the actual methods of extraction have recently been described by Dr. Leather and Mr. Mukerji in a well-illustrated bulletin issued by the Pusa Research Station.

The soil from which the crude saltpetre is extracted usually contains about 3 to 5 per cent. of pure potassium nitrate, although there may be as little as 1 per cent. or as much as 29 per cent.; chlorides and sulphates are invariably present as well. The soil is scraped together in small quantities and collected by a very low caste called "Nuniah" or "Lunia," who also carry out the extraction process. An earthen chamber, called the "Kurja" or "Kothi," is first made of wet mud and then allowed to dry; the floor of this slopes somewhat from back to front, where a hole is made at the lowest point for the escape of the nitrate liquor. Raised a few inches above the floor, and supported by a few loose bricks, is a false bottom made of bamboos and matting, on which the saltpetre earth is laid with the greatest care and so trodden in that no crevices shall exist. As a rule wood ashes are mixed with the earth beforehand. The filling-in process is stopped when the layer of soil is about 6 to 8 inches in thickness; a small piece of matting is then laid on the top, and water is poured in until about one inch lies on the surface of the soil. Several hours elapse before the water has percolated and begun to flow out from the hole. It usually emerges as a fairly concentrated clear solution, coloured brown by

¹ "The Indian Saltpetre Industry." By J. W. Leather and Jatindra Nath Mukerji. Agricultural Research Institute, Pusa. Bulletin No. 24, 1911.